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ARE THERE SPECIAL NERVES FOR PAIN?

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ALL psychologists to-day acknowledge the importance of neurological investigations as bearing upon their science. They feel that they can take no step without enquiring whether the results reached by introspection accord with the facts recorded by students of nerve physiology and histology; and this, because they acknowledge that there is a correspondence between nervous activities, and effects in consciousness.

But if there be any force whatever in the argument for the thorough-going coincidence of psychic and neural phenomena, investigators in psycho-physics on their part must also take into account the records of introspective psychology.[1]

It is with hope that I may bring some help from psychology to aid our tireless neurologists that I venture to address the readers of this journal.[2]

Sensations are mental states determined by action upon our nervous system from without: in the cases which are most easily studied the nerve terminals are differentiated to react to special forms of stimulus; these terminals being localized in the well recognized sense organs, the eye, ear, nose, skin, etc.

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[1] Cf. John Stuart Mill, Logic. Bk. vi., chapter iv., end of § 2.

[2] The arguments presented here were outlined in an article published by me in *Mind* in October, 1889, and more nearly as here presented in the *Philosophical Review*, Vol. i: 6. The full argument will appear in my book on "Pleasure, Pain and Aesthetics," now in press, with much corroborative evidence from the psychological side, which in the nature of the case cannot be given here.

The sensations due to action within the organism are also doubtless referable to the direct stimulation of the nerves from sources without themselves, although within the body as a whole.

Now it happens that in ordinary life the same general kind of stimuli that produce sensations, under certain conditions produce also painfulness, and thus, not unnaturally, pains are not infrequently carelessly spoken of as sensations. It having been taken for granted that pains are sensations, neurologists have been led to undertake certain most laborious investigations, having in view the isolation of nerve tracts for pain and their terminals, and the localization of a pain "centre" in the brain.

I shall endeavor here to show; first, that the weight of psychological evidence is strongly negative to a classification of pain with sensation; and second, that the arguments brought forward in support of such a classification, and of the existence of brain localization and of nerve tracts and terminals for pain, are not crucial.

I.

Let us first consider some logical and psychological objections to the classification of pain with sensations.

1. The differentiations of the typical sensations seem to be related to differences of environmental action upon us. The eye mediates ethereal vibrations. The ear tells of air waves. Heat and cold terminals react to molecular vibrations. Taste probably deals with chemical reactions. But pains are not determined by any such special relation to our environment.

This fact in itself surely renders the sensational classification improper on purely logical grounds.

2. Pleasure and pain have been treated in relation by masters of thought from the earliest times. This weight

of authority cannot properly be ignored: such a full expression of the observation of mental states by thoughtful men is clearly a datum of psychology which cannot be passed over by any scientific man in the consideration of this subject.

Under such conditions it would seem that where pain is classed, there pleasure should be classed also.

Pleasure, however, is not naturally looked upon, or spoken of, as a sensation, but is more often relegated to the region of emotion.[3]

Since evidence has appeared that the sensations of heat and cold, which are held in relation, have specific nerve terminals, the fact of the relation between pleasure and pain would be less of an objection to the sensational view were it not for the fact that while the discovery of pain nerves has been claimed by some observers, there is not the slightest indication of the existence of pleasure nerves. This failure casts doubt upon the claim as to pain nerves, the existence of which, as we shall presently see, is denied by equally authoritative observers; for surely if the pain nerves are isolated, we should expect to find some evidence of these related pleasure nerves.

3. But the difficulty here presented becomes more marked when we consider the matter of brain locus. There is some ground for the notion that a locus has been found in the cortex for the pains of *cutting-pricking-laceration*, although this can scarcely be said to have been established.[4] On the other hand, there is not the faint-

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[3] The weakness of the argument for classifying pain as a sensation without classifying pleasure in the same way, has appealed strongly to M. Bourdon, who, in a late number of the *Revue Philosophique* (xviii. 9), has been led thus to attempt *an identification of pleasure with an already recognized sensation*. He suggests the extraordinary hypothesis that pleasure is a sensation of diffused tickling. He does not claim, however, to support his thesis with formidable arguments, or in fact with any evidence of force.

[4] The evidence, indeed, is so contradictory that it has appeared quite possible to hold, as has been done by F. Courmont in his late work, "Le Cervelet et ses Fonctions," that the cerebellum is the seat of all pleasure and pain activities, and those connected with the emotions.

est indication, to my knowledge, of the existence of a pleasure centre in the brain. This, again, evidently casts much doubt upon the claim that a pain centre has been discovered and seems to indicate that the so-called "pain centre," if its existence be verified, will probably be found to be the centre for the sensations involved in cutting and pricking, which, under the experimenter's methods, have been stimulated in painful phase. Surely, if pleasure and pain are sensations, developed probably early, perhaps earlier than any others, in the history of our race, we ought to be able to identify in the cortex the centres of their coincident activities, as we have done those of many of the other senses; or else some adequate explanation should be forthcoming for their non-appearance.[5]

Pleasure and pain show characteristics which are not noticeable in the generally recognized sensations.

4. Each of the typical sensations has a very special means of production by which it, and it only, is brought into consciousness. None of them has the characteristic which is observable in pleasure-pain, of being aroused by the widest range of psychic occurrences.

Sensations are pleasurable and painful. Pains, indeed, as we see, are so closely related to sensations that an attempt is made to bring them together in classification.

But *emotions* also are pre-eminently pleasure-pain colored. Pleasure is, in common parlance, spoken of as an emotion; and emotions are usually treated by English psychologists together with pleasure and pain.

Intellectual pleasures and *intellectual* pains, again, are well known to all thoughtful people.

Certainly we have here phenomena very different from anything noticeable with the recognized sensations. We never, for instance, have a cold thought as we have a painful thought or a sonorous emotion as we have a pleasurable emotion.[6]

5. Under continuation of stimulative conditions, the typical sensations do not habitually change from one

form to another. A definite stimulus does not habitually alter from a pressure into a sound, nor from a sound into a brightness. But under continuation of stimulative conditions, pleasure *habitually* fades into pain, although there are some relatively few exceptions, probably traceable, as I have elsewhere argued, to alterations in the system which really bring about a change in what *appear* to be continuous stimulative conditions.

6. Again, in the case of ordinary sensations, within the limits of normal activity, increasing or diminishing intensity of physical stimulation bring corresponding alterations of psychic activity, although the relation is complex and not simple. But with pleasure-pain the case is quite different. An increase of intensity of stimulus often at first increases a pleasure, then decreases it, then produces an increasing painfulness,—a series of which we have no counterpart in sensational experience.

7. The alterations of pleasure-pain phase which are observed in connection with identical stimuli at different times are apparently incompatible with the sensational hypothesis. Hypernormal activity in any special direction often produces pleasure at one moment and pain at another, the change occurring often within narrow time limits. Are we to suppose that under certain conditions the pain-sense organs are affected by a given stimulus and the pleasure organs not, while under some mysteri-

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[5] Cf. Lehmann *Der Hauptgesetze d. menschlichen Gefuhlsleben*, p. 159. f f

[6] Wundt. in a late study (Phil. Stud., Bd. VI., Hft, III., p. 359), states the relation thus: "Ein Unterschied freilich bleibt zwischen Gefühl und Empfindung, der auf wesentlich andere Bedingungen des ersteren hinweist. Die Empfindung ist nicht nur selbst ein einfaches, unzerlegbares Element unseres Bewusstseins, sondern auch ihre Entstehungsbedingungen sind relativ einfache, beruhend auf bestimmten psycho-physischen Organisationsverhältnissen, die bei den verschiedenen Empfindungen als wesentlich übereinstimmende erscheinen. Ganz anders das Gefühl. Von dem sinnlichen Gefühl an, welches uter ähnlich einfachen Bedingungen zu stehen scheint wie die Empfindung, bis zu den höheren intellectuellen Gefühlen bietet sich hier eine Stufenreihe höchst mannigfaltiger und immer verwickelter sich gestaltender psychologischer Entstehungsbedingungen."

ous altered conditions *with the same stimulus* the pain organs become quiescent and those for pleasure become active? We surely are in a position to ask for some explanation of this mode of stimulation so different from that found with other senses. Again, activities which are uniformly disagreeable when first experienced, if not too extreme or too long continued or too often stimulated, *ordinarily* become gradually less disagreeable and finally may be productive of pleasures. This process is commonly described as the "acquisition of tastes." The only explanation of these phenomena in terms of the sensational theory would seem to be that pain nerves become separated from activities or cease to act when the latter function, and that pleasure nerves begin to become connected with the same activities. But what has kept these pleasure nerves from atrophy during the long periods they have been inactive? And after the new connection of the activities with pleasure, why do not the pain nerves suffer atrophy, as they certainly do not? For, we find, for instance, that the man who walks little may find the action of his muscles on a *five-mile* walk very painful, but if he persevere he may come to find that definite amount of action in those muscles enjoyable and regularly required for his comfort. If, some day, however, he use these muscles in a *twenty-mile* walk, he will find that his capacity for pain in them has not disappeared. The hypothetical pain nerves have not become in the least disabled by disuse. How does it happen that for year after year we live on with practically no consciousness whatever of the existence of our intestines, until some day an irritant gives us excruciating pain? Have these supposititious pain nerves been lying dormant for so long, and yet actually gaining capacity to act with vigor, instead of becoming atrophied as other organs do?

Cases like this and the one immediately preceding it have led to the suggestion that a certain width of stimulation may be necessary to bring the pain nerves into action. If we accept this notion, we are confronted with the further difficulty that those of our activities which occur after rest are most vivid and widely effective, and yet are our most pleasurable experiences. The very same conditions which are held to bring about the stimulation of pain nerves, here seem to be productive of pleasure. How is it that the man who is well-rested and vigorous in health finds it difficult to experience pain, although he is more active than the average man? How is it, on the other hand, that the gentlest stimulus is painful to one who is exhausted by illness or who is thoroughly weary?

So much for pain. What can be the special conditions which determine the stimulation of the supposititious pleasure nerves has not yet, I believe, been even suggested.

These objections to the sensational hypothesis seem to me to be weighty enough to lead us to re-examine with care the arguments that have been presented in favor of the view.

II.

8. In the experiments commonly made in the laboratory, it is found that electrical and direct mechanical stimulations of nerve trunks, or of their terminals in certain spots, give pain, but that no sort of manipulation of these stimulations which has been tried has brought pleasure, as might be expected from the close relation of pleasure and pain which is generally acknowledged. From this it is argued that, as pleasure cannot be obtained by the activities of the nerves in question and as pain can be, there must be specific nerves for pain. But it seems to me that we may argue from the facts to a quite different conclusion, *viz.:* that the nature of the electrical or mechanical stimulus applied is such that it is always productive of the conditions of pain, and that therefore pleasure cannot be reached through the activity of these particular nerve trunks or terminals *unless they be stimulated by other less abnormal methods than those thus far adopted by the experimenter.* This view is strength-

ened by evidence which we have that certain nerves have a very limited capacity for action under the conditions which make pleasure production possible. In certain directions we must have a *summation* of gentle stimulations if pleasure is to be noticed. The delicious softness of down and the agreeable smoothness of satin cannot be appreciated unless broad surfaces are affected at one time. It is even possible, indeed, that certain sensational nerves may be *practically* incapable of reacting under the conditions which pleasure implies. Surely from these facts we gain no convincing argument in favor of specific pain nerves.

Under the view that I have above suggested there is no difficulty in accounting for the fact that the inner organs, of which we are nearly or entirely unconscious in normal health and do not recognize pleasurably, still are productive of pain under the abnormal conditions of disease or under the artificial stimulations of the investigator; and the argument[7] from these facts also loses its force.

9. It is held that certain nerve trunks, when excessively stimulated by the methods open to the experimenter, do not give pain. This, it is claimed, shows that there is no capacity to produce pain in the organs which have been stimulated. The claim is too wide, however; for, granting the facts, all that is really shown is that nerves which would give pain under the experimental conditions are separate from the trunks which the stimulation reaches. It is not clear, however, that the facts are to be conceded. Evidence cannot be felt to be decisive by the advocates of the view which it is supposed to corroborate, if they think it is necessary to state it as hesitatingly as they do.[8] I think the argument cannot, on any ground, be considered a very satisfactory one when we consider the great difficulties attending the

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[7] Cf. Goldscheider, Archiv f. Anatomie u. Physiologie (Physio. Ab.), 1885, p. 341.

[8] Cf., for instance, Nichols, Origin of Pleasure and Pain (*Phil. Rev.* I.) p. 407, i. 17, i. 23; p. 417, i. 21.

production of the artificial and delicate stimulations relied upon, and the greater difficulty of obtaining these results in subjects whose tale of absence of pain can be considered scientifically conclusive.

10. It is shown that where one operation brings both touch (*e. g.*) and pain, in many cases the pain arises distinctly *after* the touch, etc. So far as the statement is true for normal subjects, the facts certainly here argue that separate sets of organs have been stimulated successively. The possibility is not precluded, however, of there being in such cases a certain sensation other than the pain, to which this pain belongs, which sensation follows the sensation of touch, etc. In other words, it is quite possible to argue from the observed facts that *touch* is followed by sensation X in a painful phase.

As Lehmann says,[9] it appears "dass ein Gefühlston, dieser sei nun Lust oder Unlust, nie von einer wenn noch so schwachen Empfindung isoliert vorkommt, und dass man in allen solchen Fällen, wo man eine Sonderung beobachtet zu haben meint, das Empfindungselement nur übersehen hat."

What has seemed to be the clearest piece of evidence of separateness in this connection loses its force under closer study. It has been often noted that a person touching a very hot body, distinctly feels the touch first, and afterwards feels the pain produced by the burning. Lehmann,[10] however, has shown that the reaction time for warmth is much longer than that for pressure, and that therefore we should *expect* that a person touching a very hot body would feel the painless touch before the painful burning.

When one presses a needle into the skin, the touch sensation may precede the pricking pain ; but this may result from the fact that certain other nerve elements than those of touch are affected after the needle has pierced the skin, namely, those which bring about the pricking sensation. I am perfectly willing to believe, indeed, that a set of nerves and nerve terminals other than those affected by action upon the surface organs of pressure, heat, and cold, may be discovered, and that we shall find them to be brought into action by rupture of the surface, by laceration, by cutting, by piercing; and I think it will be allowed as *possible* that the action of these nerves under the conditions involved in the usual experiment must always be painful; but there is here surely no crucial argument to show that specific pain nerves have been discovered. In those morbid cases where several seconds elapse after the sensations of touch and cold are felt before the pricking pain arises, we may surmise that some disturbance has occurred which has delayed the action of the nerves affected by the laceration or cutting or pricking of painful degree. Such restrictions of activities we find in the other recognized sensations.

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[9] *Der Hauptgesetze d. menschlichen Gefuhlsleben*, p. 33.

[10] *Op. cit.* pp. 44, 45, Lehmann's whole argument in this connection is well worth reading, and is, in my opinion, conclusive.

The facts of *analgesia* which have been held to tell in favor of the existence of special pain nerves may also be found to be explicable in some similar manner. We may interpret the observed results to mean that the capacity to experience one form of sensation (*e. g.* cutting, pricking), in certain parts of the body may be cut off, together with the capacity for pain-giving which goes with it, without cutting off in the same parts the capacity to experience other sensations (*e. g.* those of pressure, heat, cold) with their capacity for pain-giving.

11. Schiff and his followers have been led to argue for special pain paths in the spinal cord, by the observation that under certain morbid pathological conditions or by the use of anæsthetics all the generally-recognized senses may be lost to the lower extremities, whilst the pains produced by pricking or cutting remain. But, as in the case preceding this, it certainly is possible to argue from these observations that the other sensations are cut off, leaving only the sensation of pricking-cutting, which is always stimulated painfully under the methods adopted by the experimenters.

Wundt (Phy. Psy. 3d edition, p. 114), has pointed out that the facts as we have them do not necessarily imply the existence of distinct transmissive fibres for pain separate from those of the generally recognized sensations. Cf. also Theo. Lipps *Grund d. Seelen lebens*, pp. 202 205, 206. Mantegazza, in his *Physiologie de la Douleur* (chap. x.), after carefully going over the disputed ground finds it necessary to acknowledge (notwithstanding a strong personal inclination to the contrary view) that science to-day does *not* admit the isolation of any special fibres for the transmission of pain.

Mr. B. I. Gilman, in his late article on "Pain and Pleasure" (*Am. Jour. of Psy.*, vi., 1, p. 20), says: "Vulpian finds the hypothesis of special nerves of pain untenable (Deschambe's Dict. des Sciences Medicales Art. Phys. de la Moelle Epiniere, p. 420), and the evidence of their existence is at least insufficient according to Beaunis (Sensations Interne, p. 210, f. cf. Kulpe "Zur theorie der Sinnlichen Gefuhle," Vier. für. Wiss. Phil., XI. 4, 187, ch. ii., § 2)."

12. Finally, we have the argument from the important experiments made by Goldscheider, in which it is claimed that he has isolated pain nerves and terminals. Goldscheider's early experiments led him to the important discovery of pressure spots, cold spots, heat spots, in the skin surfaces, but did not lead him to believe that his observations told of pain spots; later—led doubtless by his interest in the theory of *specific energies*—he came to the conclusion that the evidence did speak in favor of pain spots also.[11] The article declaring for this latter position was published in 1885. Since then he has made many investigations, but principally in relation to the pressure, heat, and cold spots. His words have often implicity denied the theory of specific pain nerves; but this may be passed over.[12] In the same year, 1885, Blix published in the *Zeitschrift für Biologie* a series of obser-

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[11] Cf. *Archiv. f. Anatomie u. Physiologie* (*Physio. Ab.*), 1885, Sup. p. 87.

[12] Cf., for instance, *op. cit.* p. 345; also Sup. pp. 19, 88; also his later discussion in Dubois Reymond's *Archiv.*, 1891, p. 164.

vations and a discussion covering the same general ground, and his conclusion is that "there are three specific kinds of nerve apparatus in the skin, one for heat, one for cold, and one for pressure. For the sense of pain there are no specific organs proven in the skin" (vol. xxi., p. 160). It does not seem to me that there has ever been sufficient ground for holding that Goldscheider's results are conclusive. Wundt, in rewriting his *Physiologische Psychologie* for the third edition, has recognized Goldscheider's discoveries in relation to the heat, cold, and pressure spots, but he does not agree that he has proven his case with reference to pain.[13] Professor Ladd, in his late *Elements of Physiological Psychology*,[14] seems more inclined to take Goldscheider's word for it ; but even he does not think the case proven. Lehmann's[15] argument is, in my opinion, a perfectly satisfactory reply to Goldscheider's claims. Even if we accept, for the sake of argument, the correctness of the facts as stated by Goldscheider, it seems to me highly probable that it will be necessary to reinterpret them, perhaps in accordance with the hypothesis I have above suggested in reference to argument 4, in terms of which they are, in my opinion, readily statable as follows: that the nerves in question and their terminal organs are those of the cutting-pricking sensation, or some other form of sensibility, which always occurs in markedly painful phase under the conditions involved in the methods adopted by experimenters.

I have above presented all arguments of moment which to my knowledge have been brought forward to substantiate the view that pleasure and pain are to be classified with sensation. It seems to me that any unbiassed observer must grant that the utmost that can be claimed for these arguments is that they furnish ground for the provisional acceptance of the view in question as a working hypothesis *unless objections to the acceptance of the hypothesis appear in other directions.* But it seems to me that the arguments presented in the first part of this article have shown us that very formidable objections to the hypothesis *do* appear from other points of view. Furthermore, it can be shown, I think, that there is another hypothesis relative to pleasure and pain, which is not in disaccord with the observations that have been used as arguments supporting the sensational view, and which explains with seeming adequacy the facts I have raised in objection to that view.[16]

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[13] Vol. i.f pp. 395, 409.

[14] P. 512. Cf. Lloyd Morgan, *Animal Life and Intelligence*, p. 378; also Theo. Lipps *Grundthatsachen d. Seelen lebens*, p. 202 ; also pp. 205, 206, ff., as in general upholding my consention.

[15] *Op. cit*,. p. 37 ff.

If the reader grant that the argument given above is effective, and that pleasures and pains can in no proper sense be classed with sensations, then, it appears to me, neurologists are wasting valuable labor in the search for "pain paths" and for "pain localization" in the cortex of the brain: the paths in the spinal cord, and the supposed nerve terminals which have attracted the attention of investigators, thus appearing to be paths or terminals of nerve, mediating some form of sensibility, which, under the conditions of examination are always painful. For surely if pain and pleasure are qualities of all elements of consciousness, as appears from the evidence elsewhere collected, there is every chance that there are no special organs for either pain or pleasure, but that their physical basis will be found in a correspondence with some general properties brought out in all functioning of nervous tissue.

As a final word, let me make a comparison which may set my contention in a clear light.

A certain increased stimulation brings increased *intensity*: do our neurologists think they are called upon to look for some specific nerve paths to the brain, or some locus in the brain, for *intensity*? But pleasure and pain appear to me to be not dissimilar qualities of sensibility: with them as with intensity a certain increased stimulation makes the sensation at one time pleasurable and again painful, and at times so painful that we can attend to nothing else than the painfulness; but why, any more than in the case of intensity, should we feel bound to look for special nerve paths for pleasure and ain, or for any brain seat of their special activities?

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[16] Cf. my article "Pleasure, Pain and Sensation," *Phil. Rev.*, I. 6.

The Hypnotic Action of Somnal. — After describing carefully its chemical composition and the result obtained by other observers, Dr. Giovanno Memom concludes his interesting experiences in the *Bulletino de la Reale Accademia Medica di Roma*, Fas. viii, Anno xvii, as follows: In the insane, good results areo btained, especially in epileptic frenzy, paranoia, alcoholic psychose-mania, etc. It has shown its superiority over chloral sulfonal, and trional in many cases, not only by its hypnotic action, but because it is better tolerated and is not followed by any disagreeable after-effects. Contrary to the assertion of Umpfenbach in insane women, somnal has the same effect as in men, although special precautions must be taken. It is very beneficial in the insomnia of hysteria of tuberculosis, and in those patients suffering with cardiac affections, in whom it is not contra-indicated as some of the other hypnotics, because of the unfavorable sequellæ. In various cases where the other hypnotics (chloral, sulfonal, morphine,) have not given lasting and satisfactory results, somnal has succeeded without provoking any disturbance or secondary phenomena. According to Myers, somnal should have a good effect in convulsive cough, spasmodic laryngitis, asthma and chorea. The author has not been able to verify this assertion, not having had the opportunity of experimenting on such cases. The author has given the drug in three to five gramme doses, and has succeeded, in obtaining a sound sleepof from five to six hours duration. It is not followed by any deleterious effects, either on the part of the digestive, respiratory or circulatory systems. W. C. K.